

### REMARKS

Applicant acknowledges with appreciation the Examiner's withdrawal of the rejection of claims 112-116 under 35 U.S.C. §103 over United States Patent 4,524,236 in view of United States Patent 6,548,697.

Claims 109-116 are currently pending in the present application. Applicant has amended claims 109 and 112 to more particularly define the scope of the present invention. As amended, claim 109 recites that at least 10% alkene is present in the reaction zone during oxydehydrogenation and claim 112 recites the amount of nickel present in the catalyst. These amendments are supported in the specification. See, e.g., page 6, lines 4-16 and page 23, lines 4-21. Applicant has further amended claim 112 to correct an inadvertent and obvious typographical error.

These amendments do not add new matter.

Applicant requests reconsideration of the present application in view of the foregoing amendments and the following remarks.

### THE REJECTIONS

#### I. Double Patenting Rejections

The Examiner has rejected claims 109-116 under the judicially created doctrine of obviousness-type double patenting, as allegedly being unpatentable over claims 72-83 of

United States Patent 6,417,422. The Examiner has also rejected claims 109-111 under the judicially created doctrine of obviousness-type double patenting, as allegedly being unpatentable over claims 9 and 41 of United States Patent 6,355,854. And, the Examiner has provisionally rejected claims 109-111 under the judicially created doctrine of obviousness-type double patenting, as allegedly being unpatentable over claims 24 and 56 of co-pending United States application 09/815,914 (now, United States Patent 6,891,075).

To overcome this rejection, and without conceding to its propriety, applicant submits herewith a Terminal Disclaimer in compliance with 37 C.F.R. §1.321(c) and a Revocation of Power of Attorney and Power of Attorney. The Terminal Disclaimer disclaims the terminal portion of the term of any patent to be issued on the present application, United States patent application 10/719,441, that would extend beyond the expiration date of the full statutory term of United States patents 6,417,422, 6,355,854 and 6,891,075. Accordingly, applicant requests that the Examiner withdraw this rejection.

## II. Rejections under 35 U.S.C. §103(a)

1. The Examiner has maintained the rejection of claim 109 under 35 U.S.C. §103(a), as allegedly being unpatentable over United States Patent 4,524,236 (“McCain”) for the reasons of record.

Applicant respectfully submits that claim 109 is patentable over McCain for at least the reasons set forth in the August 23, 2005 Reply (“applicant’s previous Reply”). However, solely to expedite prosecution, applicant has amended claim 109 to recite preferred embodiments of the present application. Amended claim 109 is patentable over McCain for at least the following reasons.

Amended claim 109 recites a method for preparing an alkene from the corresponding alkane using a catalyst comprising nickel in which the reaction zone comprises at least about 10% of alkene during oxydehydrogenation. As detailed in applicant’s previous Reply, a significant aspect of the claimed invention is the improved performance characteristics, *i.e.*, selectivity and conversion, for the conversion of alkanes to alkenes *even* in the presence of substantial amounts of alkene in the reaction zone. The improved performance characteristics are surprising, particularly with respect to ethane conversion, because ethylene is typically *more* reactive than ethane. See, e.g., specification page 23, lines 4-21.

McCain does not teach or suggest the method of amended claim 109. McCain generally discloses a method for the oxydehydrogenation of ethane to ethylene using a calcined oxide catalyst containing Mo, V, Nb, Sb, and X, where “X” may be nickel oxide. In the McCain method, the feed composition has less than 5 volume % alkene. Col. 5, lines 1-4. Nowhere does McCain make mention of the reaction zone containing at least about 10% alkene during oxydehydrogenation. This is evident where McCain discloses effecting the

reaction in a flow reactor. (See McCain, Col. 4, lines 65-66; also Col. 5, lines 44-47). Thus, McCain does not teach or suggest that the reaction zone contains alkene *during* oxydehydrogenation as required by claim 109. Consequently, McCain does not teach or suggest all the elements required by amended claim 109.

Importantly, at the time of applicant's invention there was also no reasonable expectation of success in oxydehydrogenation methods in which the reaction zone comprises at least about 10% alkene during oxydehydrogenation with high selectivities and conversions. This is due to the product-sensitivity of most catalysts. In particular, and as discussed above, alkenes, such as ethylene, are typically more active than the corresponding alkane over most catalysts. See, e.g., specification page 23, lines 4-21. It was applicant's discovery that nickel-containing mixed-metal oxide catalysts have high selectivities and conversions for converting alkanes to alkenes *even* in the presence of substantial amounts of alkenes in the reaction zone.

For at least this reason, amended claim 109 is patentable over McCain. Accordingly, applicant requests that the Examiner withdraw this objection.

2. The Examiner has maintained the rejection of claims 109-111 under 35 U.S.C. §103(a), as allegedly being unpatentable over McCain in view of United States Patent 5,043,461 ("Ramachandran").

Applicant respectfully submits that claims 109-111 are patentable over McCain in view of Ramachandran for at least the reasons set forth in applicant's previous Reply. However, as discussed above, applicant has amended claim 109 to recite that the reaction zone comprises at least 10% alkene during oxydehydrogenation.

The combination of McCain and Ramachandran fails to teach or suggest all the elements of amended claim 109. As detailed above, McCain fails to teach or suggest a method for preparing an alkene in which the reaction zone comprises at least 10% alkene during oxydehydrogenation, as required by amended claim 109. This failure is in no way cured by the teachings of Ramachandran.

Ramachandran relates to a process for the production of oxides from hydrocarbons. In the Ramachandran method, propane is fed into a dehydrogenator where it is converted to propylene in the presence of a conventional dehydrogenation catalyst. Col. 6, lines 21-30. The effluent product stream comprising unreacted propane, propylene and hydrogen is then fed into a conventional oxidation reactor along with pure oxygen, air, preferably oxygen-enriched air and ammonia. Col. 6, lines 30-35. The effluent from the oxidation reactor is quenched and introduced under pressure into a conventional absorber/stripper unit. Col. 7, lines 3-15. The absorber/stripper unit produces a waste stream and a recycle stream. Col. 7, lines 31-34. The recycle stream contains unreacted alkane and alkene, as well as a minor quantity of oxygen. Col. 7, lines 35-38. The recycle stream is

introduced into a selective oxidation reactor containing an art-recognized catalyst for the selective reaction of oxygen and hydrogen to form water. Col. 7, lines 43-45. Thus, Ramachandran does not teach or suggest a method for preparing an alkene in which the reaction zone comprises at least 10% alkene during oxydehydrogenation.

The Examiner's relies on Ramachandran for "teaching that the recycle step of alkene to the oxyhydrogenation reaction zone would increase the overall product efficiency." Office Action, page 7. To the contrary, the skilled artisan would readily acknowledge that oxydehydrogenation catalysts tend to be product sensitive. This is especially true with respect to ethane conversion because ethylene is typically more reactive than ethane over most catalysts. See, e.g., specification page 23, lines 4-21. Importantly, it was applicant's discovery that nickel containing catalysts have high selectivities and conversions for the conversion of alkane to alkene *even* in the presence of the product alkene. Thus, the Examiner's reliance is misguided.

For at least the reasons above, the combination of McCain and Ramachandran does not render obvious applicant's claimed invention. Accordingly, applicants request that the Examiner withdraw this rejection under 35 U.S.C. §103(a).

3. The Examiner has maintained the rejection of claims 112-116 under 35 U.S.C. §103(a), as allegedly being unpatentable over McCain in view of either Ramachandran or United States Patent 5,439,859 ("Durante") for the reasons of record.

Applicant respectfully submits that claims 112-116 are patentable over McCain in combination with either Durante and Ramachandran for at least the reasons set forth in applicant's previous reply. However, solely to expedite prosecution, applicant has amended claim 112 to recite preferred embodiments of the present application. As amended, claim 112 recites the amount of nickel present in the catalyst. The combination of McCain and either Ramachandran and Durante does not teach this aspect of amended claim 112.

McCain does not disclose the catalysts used in the methods of amended claims 112-116. In particular, McCain's catalysts have the composition  $\text{Mo}_a\text{V}_b\text{Nb}_c\text{Sb}_d\text{X}_e$ , where "a" is 0.5 to 0.9, "b" is 0.1 to 0.4, "c" is 0.001 to 0.2 and "d" is 0.001 to 0.1, where "X" may be nickel oxide. While McCain states that "e" can be 0.001 to 1, it is clear that the maximum value of "e" in the composition must be less than 0.4, which is equivalent to a material containing less than about 40% nickel oxide. In contrast, amended claims 112-116 require a catalyst that includes at least about 50% of a nickel-component (*i.e.*, "x" has a value of at least 0.5). Further, McCain only exemplifies a single compound that contains 2% nickel (see, e.g., Example 10). Because McCain fails to teach or suggest using a catalyst that contains at least about 50% of a nickel-component, it fails to render obvious amended claims 112-116.

The failure of McCain to teach or suggest the catalysts used in the methods of amended claims 112-116 is in no way cured by the teachings of Ramachandran and Durante.

As detailed in applicant's previous Reply, Ramachandran makes no mention of specific dehydrogenation catalysts, let alone nickel containing catalysts. And, nowhere does Durante mention using a catalyst that includes at least about 50% of a nickel-component.

For at least the reasons above, the combination of McCain and either Ramachandran or Durante does not render obvious applicant's claimed invention. Accordingly, applicants request that the Examiner withdraw this rejection under 35 U.S.C. §103(a).

#### CONCLUSION

In view of the foregoing remarks, applicant requests that the Examiner withdraw the claim rejections and allow all claims of this application. If the Examiner believes that an interview would facilitate the resolution of any outstanding issues, he is kindly requested to contact the undersigned.

Respectfully submitted,



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